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Folting

(10) **Patent No.: US 9,436,671 B2**
(45) **Date of Patent: *Sep. 6, 2016**

(54) **DISPLAYING MULTIPLE ROW AND COLUMN HEADER AREAS IN A SUMMARY TABLE**

(71) Applicant: **Microsoft Technology Licensing, LLC**, Redmond, WA (US)

(72) Inventor: **Allan Folting**, Redmond, WA (US)

(73) Assignee: **Microsoft Technology Licensing, LLC**, Redmond, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 677 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **13/668,931**

(22) Filed: **Nov. 5, 2012**

(65) **Prior Publication Data**

US 2013/0067310 A1 Mar. 14, 2013

Related U.S. Application Data

(63) Continuation of application No. 12/369,004, filed on Feb. 11, 2009, now Pat. No. 8,312,366.

(51) **Int. Cl.**
G06F 17/00 (2006.01)
G06F 17/24 (2006.01)

(52) **U.S. Cl.**
CPC ***G06F 17/246*** (2013.01)

(58) **Field of Classification Search**
CPC G06F 17/246
See application file for complete search history.

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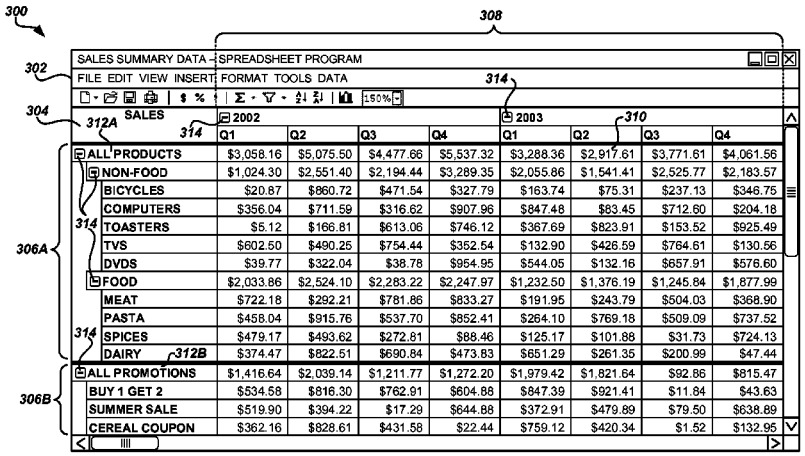
Primary Examiner — Asher Kells
(74) *Attorney, Agent, or Firm* — Damon Rieth; Tom Wong; Micky Minhas

(57) **ABSTRACT**

A data analysis program receives a selection of data fields defining multiple row header areas and/or multiple column header areas for display in a summary table. Data is read from a data source containing values for the data fields and transformed into summary level data for building the summary table. A display is rendered in the summary table for each of the multiple row header areas and column header areas defined, with the row header areas being displayed vertically adjacent to one another and the column header areas being displayed horizontally adjacent to one another.

20 Claims, 8 Drawing Sheets



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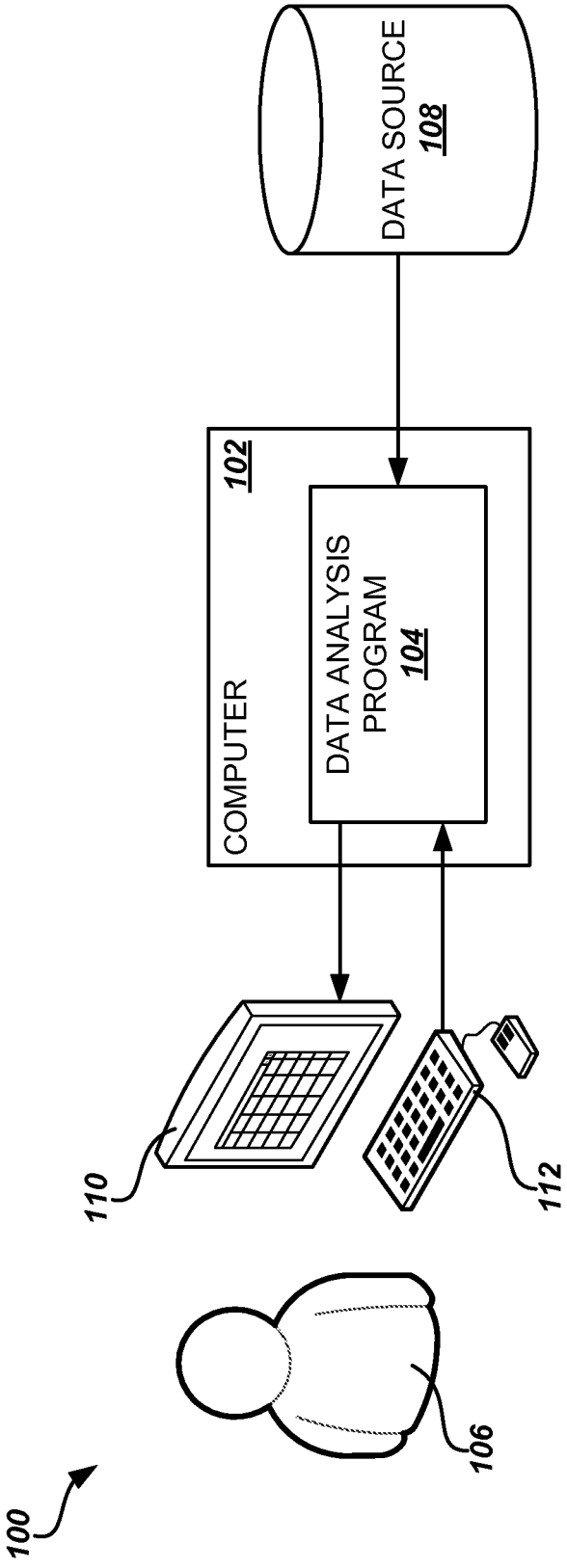
DATA SOURCE
108
COMPUTER
102
DATA ANALYSIS
PROGRAM
104
110
112
106
100

Figure 1

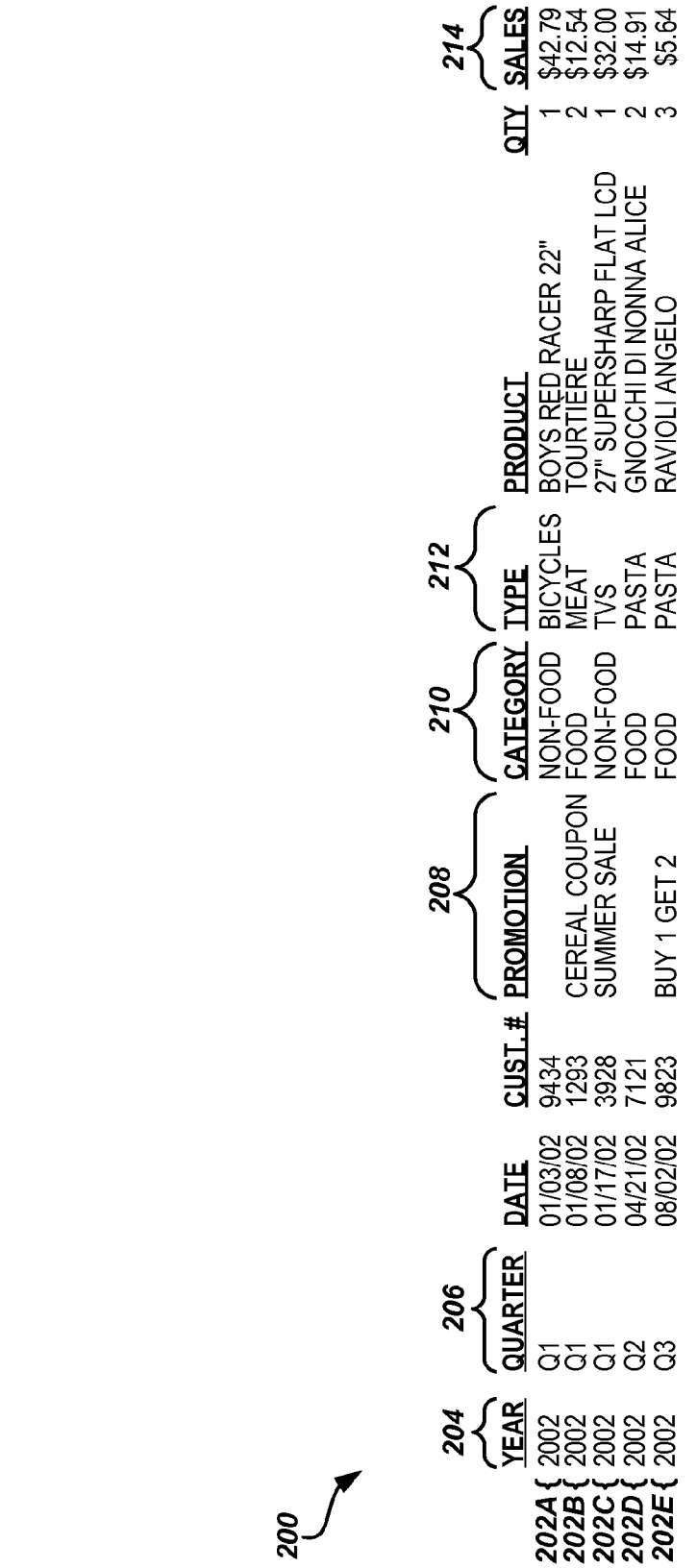
200
204
206
208
210
212
214
YEAR
QUARTER
DATE
CUST.#
PROMOTION
CATEGORY
TYPE
PRODUCT
QTY
SALES
202A { 2002 Q1 01/03/02 9434 NON-FOOD BICYCLES BOYS RED RACER 22" 1 $42.79
202B { 2002 Q1 01/08/02 1293 CEREAL COUPON FOOD MEAT TOURTIERE 2 $12.54
202C { 2002 Q1 01/17/02 3928 SUMMER SALE NON-FOOD TVS 27" SUPERSHARP FLAT LCD 1 $32.00
202D { 2002 Q2 04/21/02 7121 FOOD PASTA GNOCCHI DI NONNA ALICE 2 $14.91
202E { 2002 Q3 08/02/02 9823 BUY 1 GET 2 FOOD PASTA RAVIOLI ANGELO 3 $5.64

Figure 2

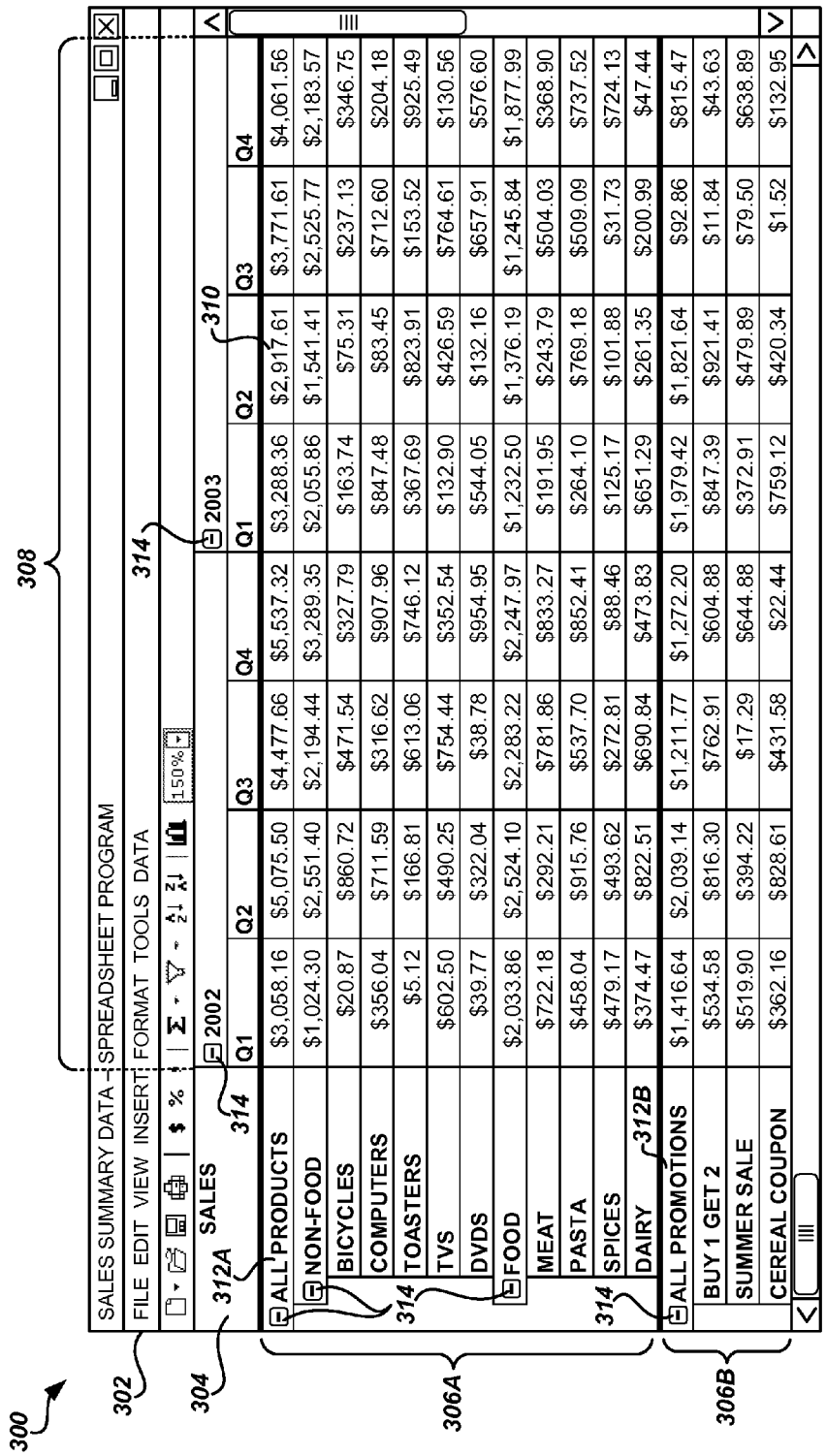
300
302
304
306A
306B
308
310
312A
312B
314
SALES SUMMARY DATA - SPREADSHEET PROGRAM
FILE EDIT VIEW INSERT FORMAT TOOLS DATA
150%
SALES
2002
2003
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
ALL PRODUCTS $3,058.16 $5,075.50 $4,477.66 $5,537.32 $3,288.36 $2,917.61 $3,771.61 $4,061.56
NON-FOOD $1,024.30 $2,551.40 $2,194.44 $3,289.35 $2,055.86 $1,541.41 $2,525.77 $2,183.57
BICYCLES $20.87 $860.72 $471.54 $327.79 $163.74 $75.31 $237.13 $346.75
COMPUTERS $356.04 $711.59 $316.62 $907.96 $847.48 $83.45 $712.60 $204.18
TOASTERS $5.12 $166.81 $613.06 $746.12 $367.69 $823.91 $153.52 $925.49
TVS $602.50 $490.25 $754.44 $352.54 $132.90 $426.59 $764.61 $130.56
DVDS $39.77 $322.04 $38.78 $954.95 $544.05 $132.16 $657.91 $576.60
FOOD $2,033.86 $2,524.10 $2,283.22 $2,247.97 $1,232.50 $1,376.19 $1,245.84 $1,877.99
MEAT $722.18 $292.21 $781.86 $833.27 $191.95 $243.79 $504.03 $368.90
PASTA $458.04 $915.76 $537.70 $852.41 $264.10 $769.18 $509.09 $737.52
SPICES $479.17 $493.62 $272.81 $88.46 $125.17 $101.88 $31.73 $724.13
DAIRY $374.47 $822.51 $690.84 $473.83 $651.29 $261.35 $200.99 $47.44
ALL PROMOTIONS $1,416.64 $2,039.14 $1,211.77 $1,272.20 $1,979.42 $1,821.64 $92.86 $815.47
BUY 1 GET 2 $534.58 $816.30 $762.91 $604.88 $847.39 $921.41 $11.84 $43.63
SUMMER SALE $519.90 $394.22 $17.29 $644.88 $372.91 $479.89 $79.50 $638.89
CEREAL COUPON $362.16 $828.61 $431.58 $22.44 $759.12 $420.34 $1.52 $132.95

Figure 3A

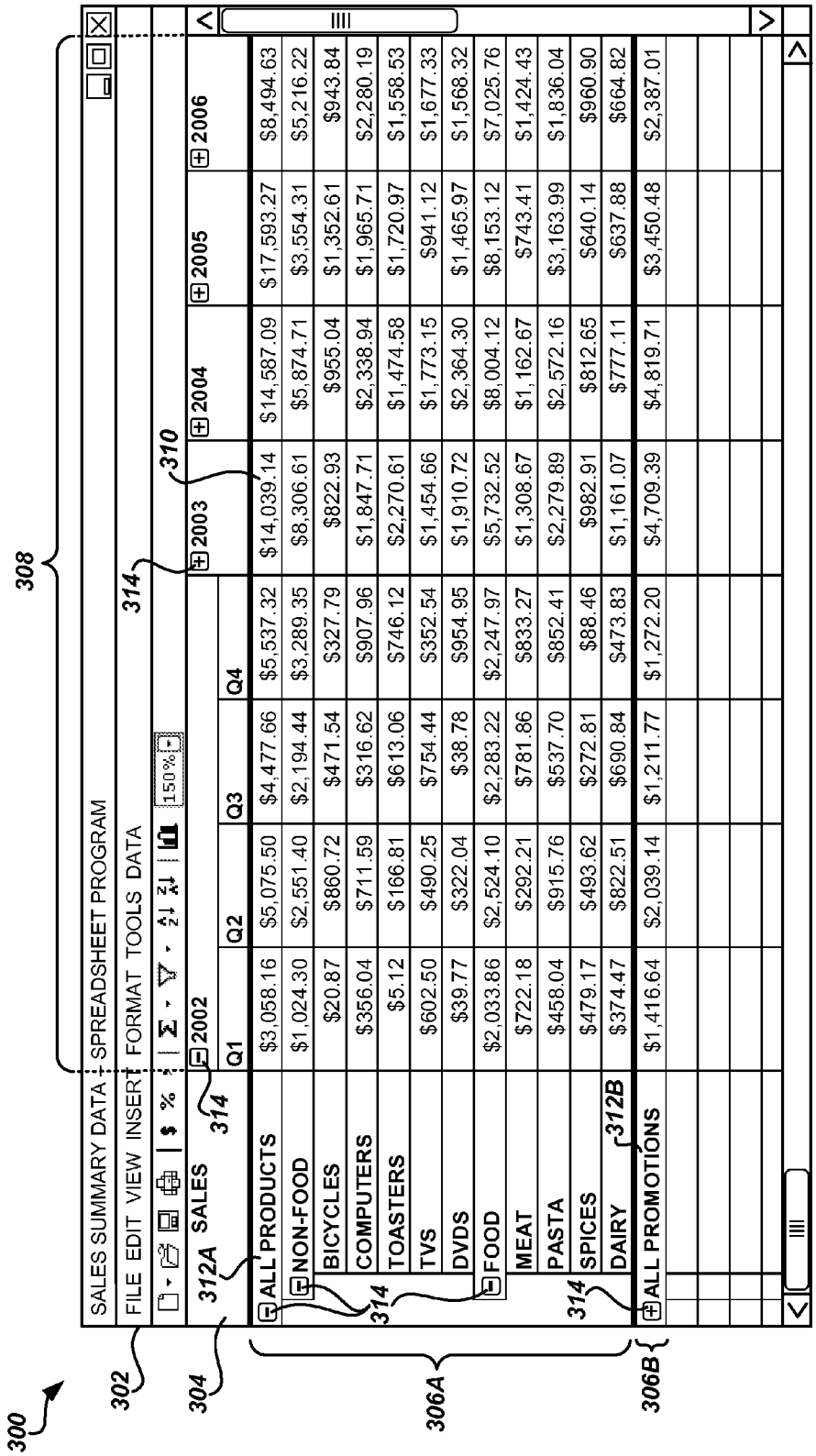
300
302
304
306A
306B
308
310
312A
312B
314
SALES SUMMARY DATA - SPREADSHEET PROGRAM
FILE EDIT VIEW INSERT FORMAT TOOLS DATA
150%
SALES
2002
2003
2004
2005
2006
Q1
Q2
Q3
Q4
ALL PRODUCTS $3,058.16 $5,075.50 $4,477.66 $5,537.32 $14,039.14 $14,587.09 $17,593.27 $8,494.63
NON-FOOD $1,024.30 $2,551.40 $2,194.44 $3,289.35 $8,306.61 $5,874.71 $3,554.31 $5,216.22
BICYCLES $20.87 $860.72 $471.54 $327.79 $822.93 $955.04 $1,352.61 $943.84
COMPUTERS $356.04 $711.59 $316.62 $907.96 $1,847.71 $2,338.94 $1,965.71 $2,280.19
TOASTERS $5.12 $166.81 $613.06 $746.12 $2,270.61 $1,474.58 $1,720.97 $1,558.53
TVS $602.50 $490.25 $754.44 $352.54 $1,454.66 $1,773.15 $941.12 $1,677.33
DVDS $39.77 $322.04 $38.78 $954.95 $1,910.72 $2,364.30 $1,465.97 $1,568.32
FOOD $2,033.86 $2,524.10 $2,283.22 $2,247.97 $5,732.52 $8,004.12 $8,153.12 $7,025.76
MEAT $722.18 $292.21 $781.86 $833.27 $1,308.67 $1,162.67 $743.41 $1,424.43
PASTA $458.04 $915.76 $537.70 $852.41 $2,279.89 $2,572.16 $3,163.99 $1,836.04
SPICES $479.17 $493.62 $272.81 $88.46 $982.91 $812.65 $640.14 $960.90
DAIRY $374.47 $822.51 $690.84 $473.83 $1,161.07 $777.11 $637.88 $664.82
ALL PROMOTIONS $1,416.64 $2,039.14 $1,211.77 $1,272.20 $4,709.39 $4,819.71 $3,450.48 $2,387.01

Figure 3B

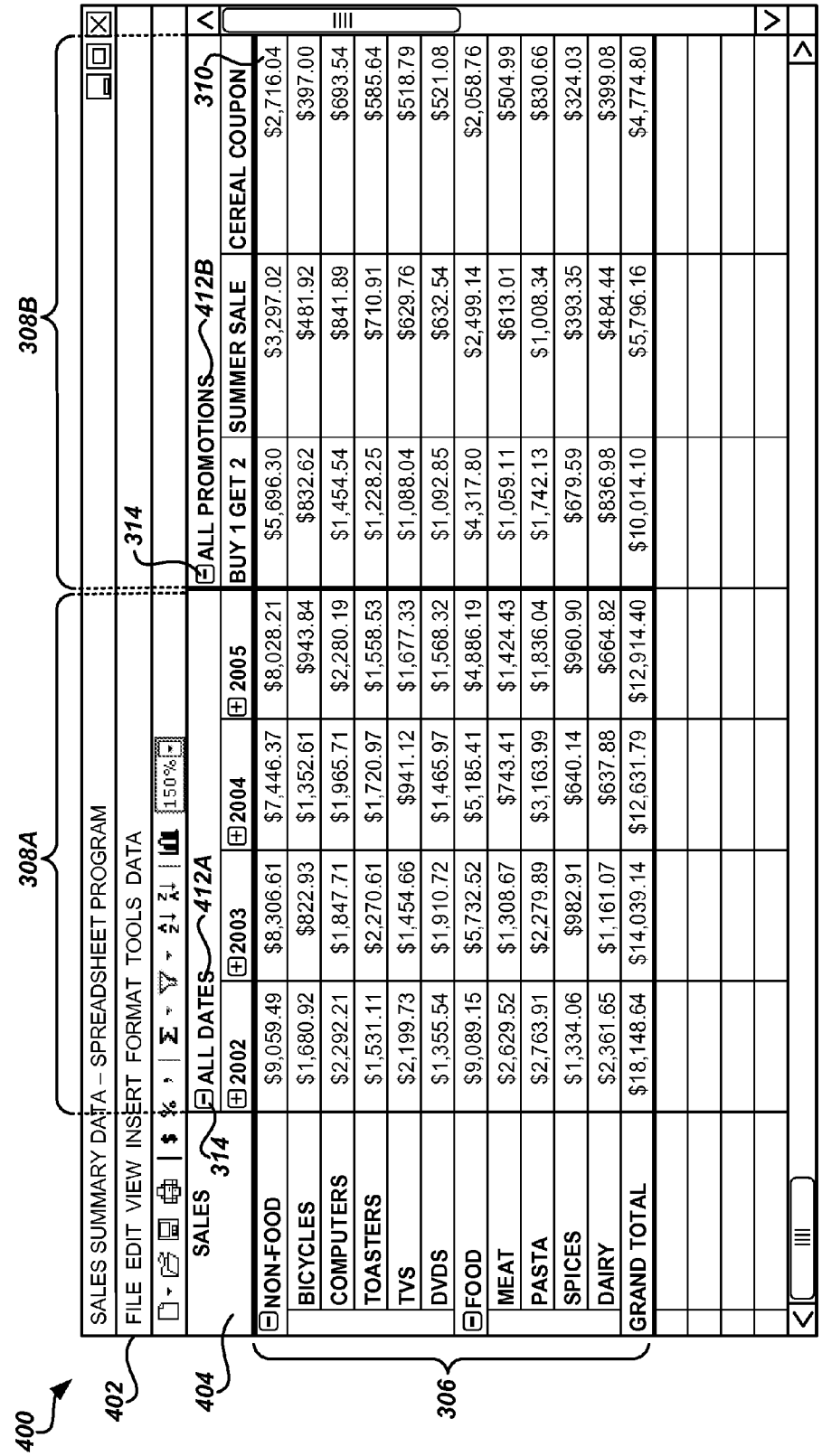
400
402
404
306
308A
308B
314
314
412A
412B
310
SALES SUMMARY DATA – SPREADSHEET PROGRAM
FILE EDIT VIEW INSERT FORMAT TOOLS DATA
150%
SALES
ALL DATES
ALL PROMOTIONS
2002
2003
2004
2005
BUY 1 GET 2
SUMMER SALE
CEREAL COUPON
NON-FOOD $9,059.49 $8,306.61 $7,446.37 $8,028.21 $5,696.30 $3,297.02 $2,716.04
BICYCLES $1,680.92 $822.93 $1,352.61 $943.84 $832.62 $481.92 $397.00
COMPUTERS $2,292.21 $1,847.71 $1,965.71 $2,280.19 $1,454.54 $841.89 $693.54
TOASTERS $1,531.11 $2,270.61 $1,720.97 $1,558.53 $1,228.25 $710.91 $585.64
TVS $2,199.73 $1,454.66 $941.12 $1,677.33 $1,088.04 $629.76 $518.79
DVDS $1,355.54 $1,910.72 $1,465.97 $1,568.32 $1,092.85 $632.54 $521.08
FOOD $9,089.15 $5,732.52 $5,185.41 $4,886.19 $4,317.80 $2,499.14 $2,058.76
MEAT $2,629.52 $1,308.67 $743.41 $1,424.43 $1,059.11 $613.01 $504.99
PASTA $2,763.91 $2,279.89 $3,163.99 $1,836.04 $1,742.13 $1,008.34 $830.66
SPICES $1,334.06 $982.91 $640.14 $960.90 $679.59 $393.35 $324.03
DAIRY $2,361.65 $1,161.07 $637.88 $664.82 $836.98 $484.44 $399.08
GRAND TOTAL $18,148.64 $14,039.14 $12,631.79 $12,914.40 $10,014.10 $5,796.16 $4,774.80

Figure 4

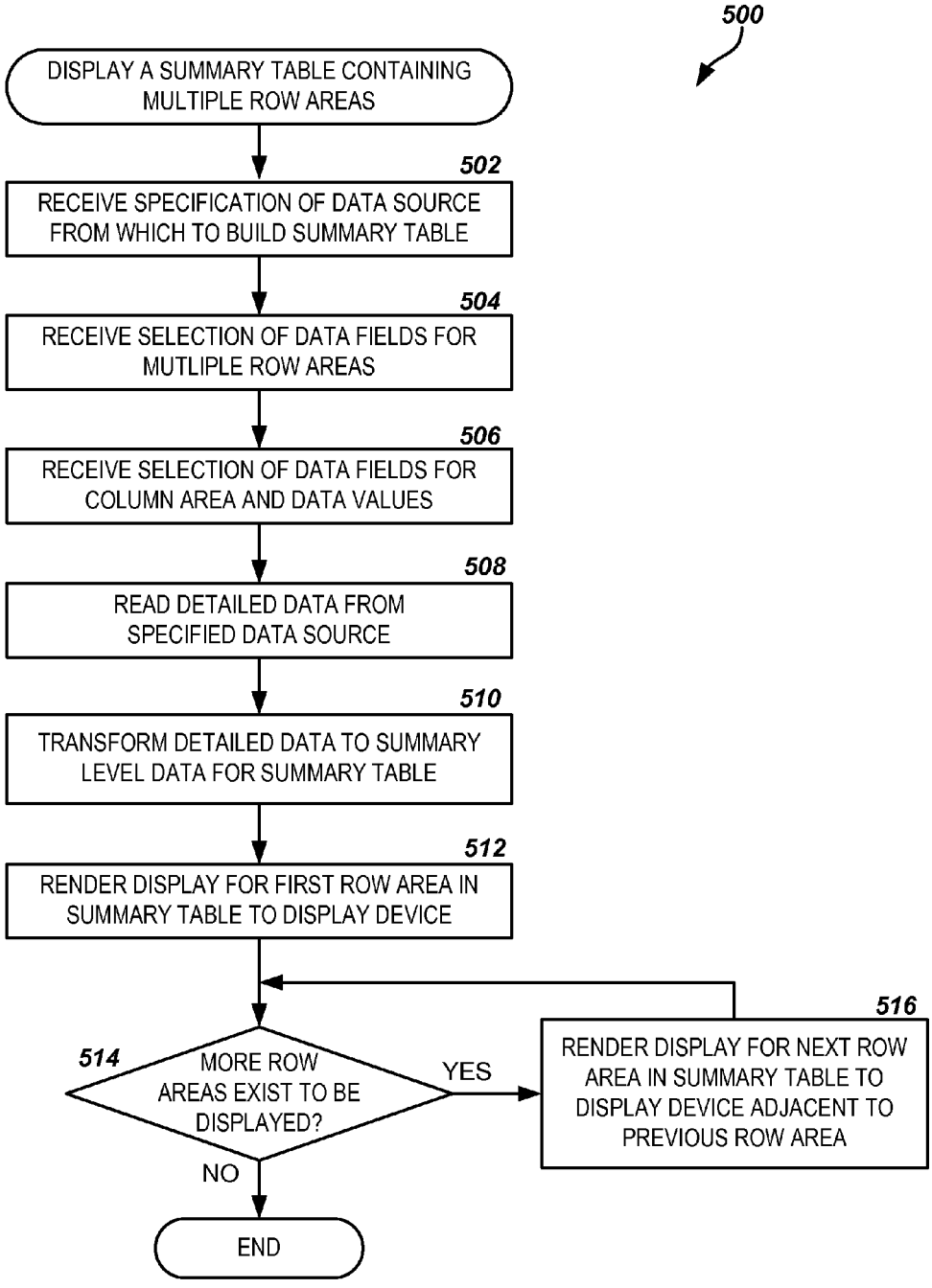
500
DISPLAY A SUMMARY TABLE CONTAINING MULTIPLE ROW AREAS
502
RECEIVE SPECIFICATION OF DATA SOURCE FROM WHICH TO BUILD SUMMARY TABLE
504
RECEIVE SELECTION OF DATA FIELDS FOR MUTLIPLE ROW AREAS
506
RECEIVE SELECTION OF DATA FIELDS FOR COLUMN AREA AND DATA VALUES
508
READ DETAILED DATA FROM SPECIFIED DATA SOURCE
510
TRANSFORM DETAILED DATA TO SUMMARY LEVEL DATA FOR SUMMARY TABLE
512
RENDER DISPLAY FOR FIRST ROW AREA IN SUMMARY TABLE TO DISPLAY DEVICE
514
MORE ROW AREAS EXIST TO BE DISPLAYED?
YES
516
RENDER DISPLAY FOR NEXT ROW AREA IN SUMMARY TABLE TO DISPLAY DEVICE ADJACENT TO PREVIOUS ROW AREA
NO
END

Figure 5

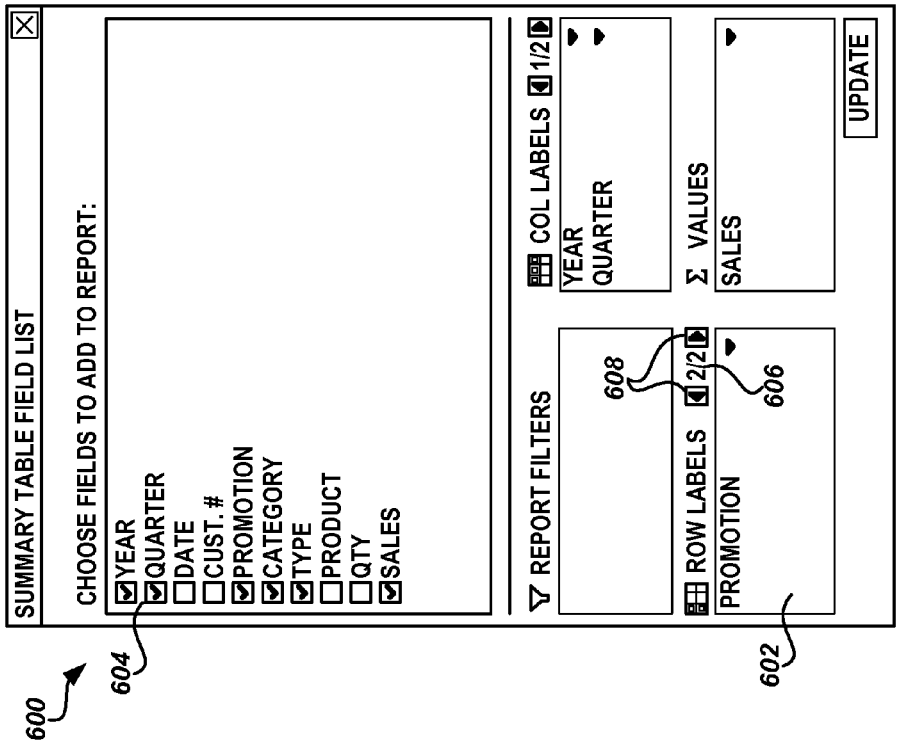

Figure 6B

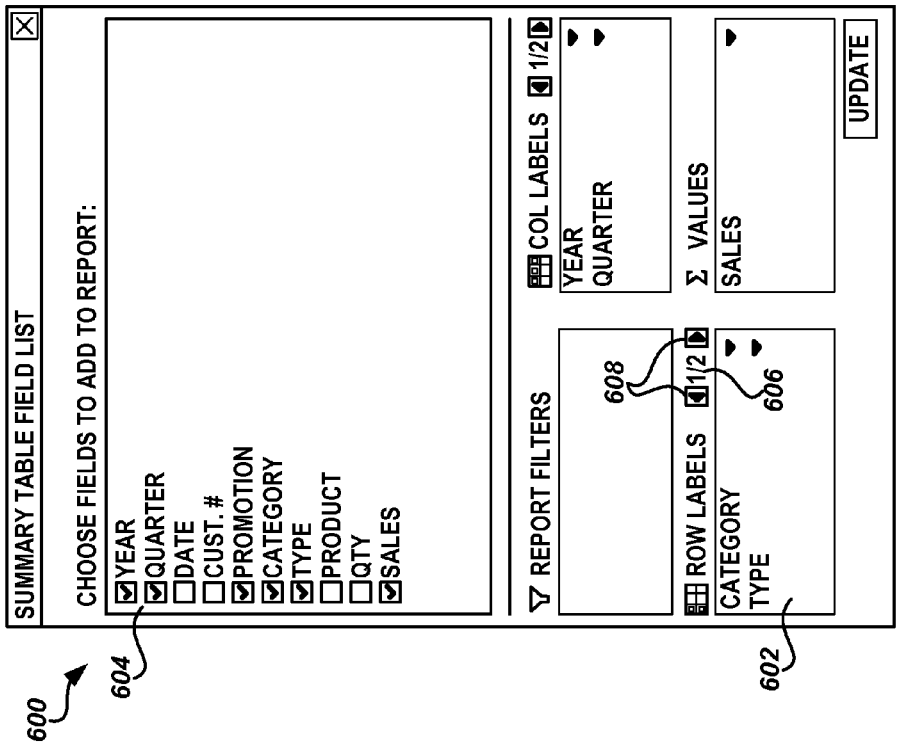

Figure 6A

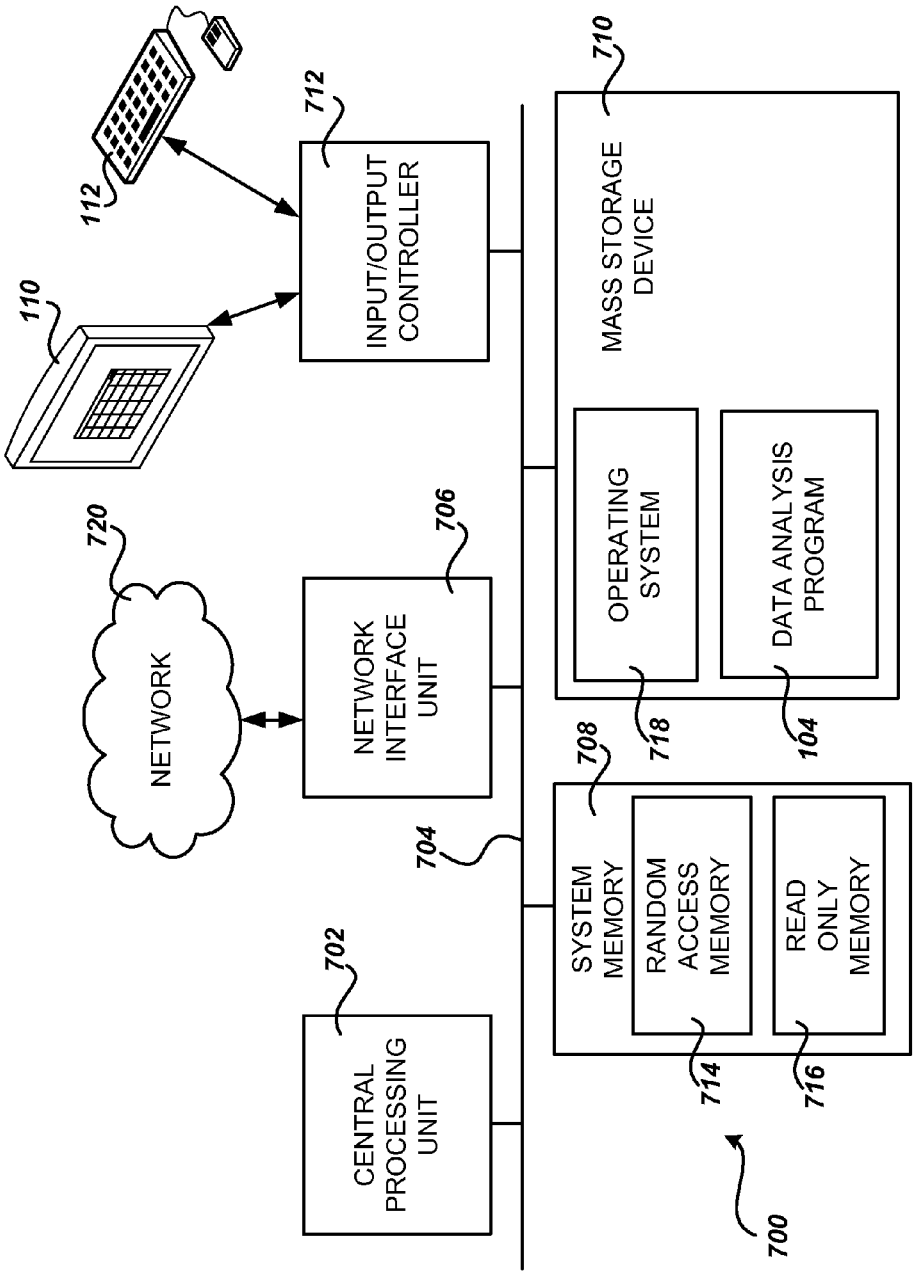
112
110
712
INPUT/OUTPUT CONTROLLER
710
MASS STORAGE DEVICE
OPERATING SYSTEM
DATA ANALYSIS PROGRAM
720
NETWORK
706
NETWORK INTERFACE UNIT
708
718
104
704
SYSTEM MEMORY
RANDOM ACCESS MEMORY
READ ONLY MEMORY
714
716
702
CENTRAL PROCESSING UNIT
700

Figure 7

DISPLAYING MULTIPLE ROW AND COLUMN HEADER AREAS IN A SUMMARY TABLE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. application Ser. No. 12/369,004 filed Feb. 11, 2009, now U.S. Pat. No. 8,312,366, entitled "Displaying Multiple Row and Column Header Areas in a Summary Table," which is incorporated herein by reference.

BACKGROUND

A summary table is a data summarization tool that allows detailed, transactional source data to be "rolled-up" or summarized at varying levels of detail. Summary table functionality, also known as pivot tables, can be found in data visualization and analysis programs such as spreadsheets programs and data reporting tools. The data analysis program may allow a user to draw the summary table as a grid, specifying data fields from the source data for the row and column labels of the grid as well as the data values summarized in the grid. The data analysis program may then group, sort, count, and/or total the data values in the grid based on the row and column labels extracted from the source data.

The data analysis program may allow the user to specify multiple data fields for the row and/or column labels of the summary table. In this case, the data analysis program traditionally displays the data values summarized hierarchically by the row or column labels based on the order of the data fields specified. The data analysis program may also allow the user to interactively manipulate the summary table, expanding and collapsing row labels or column labels in the hierarchy to display more or fewer data values, depending on the user's requirements.

Traditional implementations of summary tables are limited to a single set of row labels, or "row header area," and single set of column labels, or "column header area." As a consequence, a user wishing to have data summarized for two distinct views of data, for example, two different row headers areas based on different or the same data fields from the source data summarized across a common set of column labels, may have to build two separate summary tables. This creates a cumbersome process requiring redundant parameters to be specified as well as redundant displays of the common column labels. This also limits the ability of the distinct views of data to be manipulated together, for example, by grouping, expanding, or collapsing column labels or applying table level filters or other table level operations.

It is with respect to these considerations and others that the disclosure made herein is presented.

SUMMARY

Technologies are described herein for displaying multiple row and column header areas in a summary table. Utilizing the technologies described herein, a data analysis program may display multiple row header areas, multiple column header areas, or both in a single summary table. This may allow a user of the data analysis program to create two or more distinct views of summarized data that may be expanded or collapsed, sorted, or filtered independently, while allowing the views to be manipulated together in the context of the overall summary table.

According to one embodiment, a data analysis program receives a selection of data fields defining multiple row header areas and/or multiple column header areas for display in a summary table. Data is read from a data source containing values for the data fields and transformed into summary level data for constructing the summary table. A display is rendered in the summary table for each of the multiple row header areas and column header areas defined, with the row header areas being displayed vertically adjacent to one another and the column header areas being displayed horizontally adjacent to one another.

It should be appreciated that the above-described subject matter may be implemented as a computer-controlled apparatus, a computer process, a computing system, or as an article of manufacture such as a computer-readable medium. These and various other features will be apparent from a reading of the following Detailed Description and a review of the associated drawings.

This Summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This Summary is not intended to identify key features or essential features of the claimed subject matter, nor is it intended that this Summary be used to limit the scope of the claimed subject matter. Furthermore, the claimed subject matter is not limited to implementations that solve any or all disadvantages noted in any part of this disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram showing aspects of an illustrative operating environment and several software components provided by the embodiments presented herein;

FIG. **2** is a data listing showing exemplary source data used in constructing a summary table, according to embodiments described herein;

FIGS. **3**A and **3**B are screen diagrams showing one example of displaying a summary table containing multiple row header areas, according to embodiments described herein;

FIG. **4** is a screen diagram showing another example of displaying a summary table containing multiple column header areas, according to embodiments described herein;

FIG. **5** is a flow diagram showing one method for displaying multiple row header areas in a summary table, according to embodiments described herein;

FIGS. **6**A and **6**B are screen diagrams showing an exemplary user interface for specifying data fields for multiple row and/or column header areas for display in a summary table, according to embodiments described herein; and

FIG. **7** is a block diagram showing illustrative computer hardware and software architectures for a computing system capable of implementing aspects of the embodiments presented herein.

DETAILED DESCRIPTION

The following detailed description is directed to technologies for displaying multiple data row and column header areas in a summary table. While the subject matter described herein is presented in the general context of program modules that execute in conjunction with the execution of an operating system and application programs on a computer system, those skilled in the art will recognize that other implementations may be performed in combination with

other types of program modules. Generally, program modules include routines, programs, components, data structures, and other types of structures that perform particular tasks or implement particular abstract data types. Moreover, those skilled in the art will appreciate that the subject matter described herein may be practiced with other computer system configurations, including hand-held devices, multiprocessor systems, microprocessor-based or programmable consumer electronics, minicomputers, mainframe computers, and the like.

In the following detailed description, references are made to the accompanying drawings that form a part hereof, and that show, by way of illustration, specific embodiments or examples. In the accompanying drawings, like numerals represent like elements through the several figures.

FIG. **1** shows an illustrative operating environment **100** including several software components for displaying multiple data row and column header areas in a summary table, according to embodiments provided herein. The environment **100** includes a computer **102**. The computer **102** may be a personal computer ('PC"), a desktop workstation, a laptop, a notebook, a personal digital assistant ("PDA"), an application server, a Web server hosting Web-based application programs, or any other computing device that can execute application programs.

The computer **102** executes a data analysis program **104**. The data analysis program **104** is an application program that allows a user **106** of the computer **102** to visualize and manipulate data contained in a data source **108** accessible by the computer. The data analysis program **104** may be a spreadsheet program, such as the MICROSOFT® EXCEL® spreadsheet software from Microsoft Corporation of Redmond, Wash., or the IBM® LOTUS® 1-2-3® spreadsheet software from IBM Corporation of Armonk, N.Y. The data analysis program **104** may also be a data reporting application, such as SAP® BUSINESSOBJECTS™ CRYSTAL REPORTS from SAP, AG of Waldorf, Germany. The data source **108** may be a file system attached to or accessible by the computer **102** and may contain spreadsheet files or other data files. The data source **108** may also be a database or multi-dimensional online analytical processing ("OLAP") cube containing detailed and/or summarized data which may be queried by the data analysis program **104**.

According to embodiments described herein, the data analysis program **104** is operative to retrieve data from the data source **108** and transform the data through summarization functions into a summary table which is displayed to the user **106** on a display device **110** connected to the computer **102**. The display device **110** may be a computer monitor, a flat-panel display, a digital projector, a printer, a plotter, or any other output device attached to the computer **102**. The display device **110** may also be a Web browser application program or other application program executing on a remote computing device accessing the computer **102** over a network. The user may utilize input devices **112** connected to the computer **102** or remote computing device, such as a keyboard, mouse, touchscreen, stylus, or trackball, to control or manipulate the display of the summary table on the display device **110**.

FIG. **2** shows an example of a source data listing **200** that may be transformed by the data analysis program **104** to the summary table displayed to the user **106** on the display device **110**. The source data listing **200** may be contained in a spreadsheet file loaded by the data analysis program **104**, or it may be provided by a database server as the result of a query issued by the data analysis program against the source data. It will be appreciated that the source data listing may be obtained by the data analysis program **104** from any number of sources known in the art beyond those described herein. The source data listing **200** may contain data rows **202**A-**202**E (referred to herein collectively as data rows **202**) representing individual transactions, such as individual sales for a retail sales company, or the data listing may contain data rows pre-summarized to a lowest level of detail desired in the summary table.

Each of the data rows **202** of the source data listing **200** may contain a number of data fields, such as the year field **204**, the quarter field **206**, the promotion field **208**, the category field **210**, the type field **212**, and the sales field **214**, as shown in FIG. **2**. Using the data analysis program **104**, the user **106** may select one or more of these data fields from the source data listing **200** for the row labels, column labels, and data values to be displayed in the summary table. According to embodiments described herein, the data analysis program **104** may further allow the user to specify multiple, distinct sets of row label fields and/or column label fields, allowing the data analysis program to display multiple row header areas and multiple column header areas in the summary table, as will be described in more detail below.

FIG. **3**A shows an example screen display **300** of a window **302** rendered by the data analysis program **104** to the display device **110**. The window **302** contains a summary table **304** displayed by the data analysis program **104**, according to embodiments described herein. The summary table **304** consists of a grid of rows and columns constructed from the source data listing **200** described above in regard to FIG. **2**. As shown in FIG. **3**A, the summary table **304** contains two distinct sets of rows, or "row header areas" **306**A and **306**B, displayed vertically adjacent to each other in the summary table. The rows of the first row header area **306**A are labeled with values obtained from the category field **210** and type field **212** provided in the source data listing **200**. The rows of the second row header area **306**B are labeled with values obtained from the promotion field **208**. The summary table **304** also contains a single set of columns, or "column header area" **308**, labeled with the values of the year field **204** and quarter field **206** from the source data listing **200**. The data values, such as the data value **310**, of the summary table **304** consist of the summation of the sales field **214** from the source data listing **200**, across the specified category and type or promotion indicated by the row labels and within the quarter indicated by the column label, as further shown in FIG. **3**A.

As described above, when multiple fields are selected as row labels or column labels for a single row or column header area, then the data analysis program **104** may display the row or columns labels for the area as a hierarchy, based upon the order of the fields specified for the labels. For example, as shown in FIG. **3**A, the first row header area **306**A comprises row labels from the category field **210** and the type field **212**, respectively. Accordingly, the row labels for the first row header area **306**A are displayed hierarchically, with the types "rolling-up" into their respective categories. In other words, the data values for the types "BICYCLES," COMPUTERS," "TOASTERS," etc. are aggregated under the category of "NON-FOOD," while the data values for types "MEAT," "PASTA," "SPICES," etc. are aggregated under the category "FOOD." Similarly, the column header area **308** comprises labels for quarters which roll-up into their respective years.

According to one embodiment, when multiple row header areas **306**A, **306**B are present in the summary table **304**, the data analysis program **104** further provides an aggregate row label **312**A, **312**B for each row header area. For example, in

the summary table **304** shown in FIG. **3**A, an aggregate row label **312**A of "ALL PRODUCTS" is displayed in the first row header area **306**A, and an aggregate row label **312**B of "ALL PROMOTIONS" is displayed in the second row header area **306**B. All the row labels of each row header area **306**A, **306**B roll-up into their respective aggregate row label **312**A, **312**B. The aggregate row labels **312**A, **312**B allow the rows of an individual row header area **306**A, **306**B to be collapsed and summarized as a single row, without affecting the display of the other row header areas, as will be described in more detail below.

The data analysis program **104** may further provide the ability to expand and collapse the levels of a row label or column label hierarchy to allow the user **106** to manipulate the displayed summary table **304**. For example, as shown in FIG. **3**A, the data analysis program **104** may provide collapse/expand controls **314** adjacent to row and column labels in their respective hierarchies when data may be rolled up to the level represented by the label. When an individual collapse/expand control **314** is selected by a user, the rows beneath the selected row in the hierarchy are collapsed, leaving only the selected row visible, with the associated data values, such as the data value **310**, summarized at the corresponding level.

For example, if the collapse/expand control **314** adjacent to the aggregate row label "ALL PROMOTIONS" is selected by the user **106**, the data analysis program **104** may collapse the second row header area **306**B to a single row, as shown in FIG. **3**B. Similarly, if the collapse/expand control **314** adjacent to the column label "**2003**" is selected by the user **106**, the data analysis program **104** may collapse the "Q**1**," "Q**2**," "Q**3**," and "Q**4**" occurring beneath **2003** level in the corresponding hierarchy into a single column, containing data values, such as the data value **310**, summarized to the **2003** level, as further shown in FIG. **3**B.

According to another embodiment, operations performed in regard to one row header area **306**A, **306**B may be executed without affecting the display of the other row header areas in the summary table **304**. For example, as shown in FIG. **3**B, collapsing the rows of the second row header area **306**B to a single, aggregate row does not cause the rows of the first row header area **306**A to likewise collapse to a single, aggregate row. Similarly, if the data analysis program **104** applies a row-level filter, such as the selection of the top ten values, or a row-level sort to a specific row header area **306**A, **306**B, the filter or sort will affect that row header area only, while the display of other row header areas in the summary table **304** remain unaltered.

In contrast, operations performed in regard to a column header area **308** may affect all row header areas **306**A, **306**B in the summary table **304**. For example, as further shown in FIG. **3**B, collapsing the columns under the column label "**2003**" affects the display of both the first row header area **306**A and the second row header area **306**B. In addition, table level operations applied to the summary table **304**, such as table level data filters, modification of the selected data value fields, or application of summarization functions to the data values, will equally affect all row header areas **306**A, **306**B of the summary table, according to a further embodiment.

FIG. **4** shows another example screen display **400** of a window **402** rendered by the data analysis program **104** to the display device **110**. The window **402** contains a summary table **404** having two, distinct column header areas **308**A and **308**B, displayed horizontally adjacent to each other in the summary table. The columns of the first column header area **308**A are labeled with values obtained from the year field **204** and quarter field **206** provided in the source data listing **200**. The rows of the second column header area **308**B are labeled with values obtained from the promotion field **208**. The summary table **404** further contains a single row header area **306** labeled with the values from the category field **210** and type field **212** from the source data listing **200**. The data values, such as the data value **310**, of the summary table **404** consist of the summation of the sales field **214** from the source data listing **200**, as described above in regard to FIG. **3**A.

Just as described above in regard to FIGS. **3**A and **3**B, when multiple column header areas **308**A, **308**B are present in the summary table **404**, the data analysis program **104** may provide aggregate column labels **412**A, **412**B for each column header area, according to one embodiment. For example, in the summary table **404** shown in FIG. **4**, an aggregate column label **412**A of "ALL DATES" is displayed in the first column header area **308**A, and an aggregate column label **412**B of "ALL PROMOTIONS" is displayed in the second column header area **308**B. Further, according to embodiments, operations performed in regard to one column header area **308**A, **308**B, such as collapsing the column header area to a single column or applying a column level filter, may be executed without affecting the display of the other column header areas in the summary table **404**. However, operations performed in regard to the row header area **306**, or applied to the summary table **404** as a whole, may affect all column header areas **308**A, **308**B in the summary table.

It will be appreciated that additional configurations of summary tables beyond those described above may be utilized, including a summary table having a single column header area with three or more row header areas, a summary table having a single row header area with three or more column header areas, or a summary table having both multiple row header areas and multiple column header areas. In addition different fields from the source data may be selected for the data values displayed in conjunction with each of the multiple row header areas or column header areas. It will be further appreciated that the features and characteristics described herein apply equally to all such configurations, and it is intended that this application include all such configurations.

Referring now to FIG. **5**, additional details will be provided regarding the embodiments presented herein. It should be appreciated that the logical operations described with respect to FIG. **5** are implemented (1) as a sequence of computer implemented acts or program modules running on a computing system and/or (2) as interconnected machine logic circuits or circuit modules within the computing system. The implementation is a matter of choice dependent on the performance and other requirements of the computing system. Accordingly, the logical operations described herein are referred to variously as operations, structural devices, acts, or modules. These operations, structural devices, acts, and modules may be implemented in software, in firmware, in special purpose digital logic, and any combination thereof. It should also be appreciated that more or fewer operations may be performed than shown in the figures and described herein. The operations may also be performed in a different order than described.

FIG. **5** illustrates a routine **500** for rendering a summary table having multiple row header areas to a display device **110**, as described above in regard to FIGS. **3**A and **3**B. The routine **500** begins at operation **502**, where the data analysis program **104** receives a specification of a data source **108** from which to build the summary table. As described above

in regard to FIG. **1**, the data for the summary table may be retrieved from a spreadsheet file or other data file on a file system accessible by the computer **102**, or it may be contained in a database. The data from the data source **108** may be in the format of a source data listing **200**, like that described above in regard to FIG. **2**.

From operation **502**, the routine **500** proceeds to operation **504**, where the data analysis program **104** receives a selection from the user **106** of data fields for the row labels for each of the multiple row header areas **306**A, **306**B to be displayed in the summary table **304**. For example, the user **106** may specify that the summary table **304** should have two row header areas **306**A, **306**B, with the row labels for the first row header area **306**A obtained from the category field **210** and type field **212** provided in the source data listing **200**, and the row labels for the second row header area **306**B obtained from the promotion field **208**.

According to one embodiment, the data analysis program **104** may provide a user interface ("UI"), such as the summary table field list window **600** shown in FIGS. **6**A and **6**B, to the user **106** in order for the user to make the appropriate selections of row labels for each of the multiple row header areas **306**A, **306**B. The field list window **600** includes a row label selection area **602** where the data fields for the row labels are specified. The selected data fields may be dragged from a data fields list **604** into the row label selection area **602** in order to select the data field for a row label. In order to facilitate multiple row header areas **306**A, **306**B, the row label selection area **602** may further include a current row header area indicator **606**, which shows the current row header area for which field selections may be made as well as the total number of row header areas available. The user may select a row header area selection control **608** to increment or decrement the current row header area active in the row label selection area **602**.

For example, as shown in FIG. **6**A, the user may select the category field **210** and type field **212** for row labels for the first row header area **306**A of two row header areas. By selecting the increment row header area selection control **608**, the selected fields for the second row header area **306**B may be displayed in the row label selection area **602**, which may comprise the promotion field **208**, as shown in FIG. **6**B. It will be appreciated that other UIs may be utilized for making selections of data fields for row labels for multiple row header areas, beyond those shown in FIGS. **6**A and **6**B and described herein. It is intended that this application include all such UIs.

From operation **504**, the routine **500** proceeds to operation **506**, where the data analysis program **104** receives the selection of fields for the column header area **308** and for the data values **310**. This may be accomplished using the summary table field list window **600** shown in FIGS. **6**A and **6**B and described above, or some other UI. The data analysis program **104** also receives any additional selections or parameters necessary to render the summary table **304** at operation **506**. Next, the routine **500** proceeds to operation **508**, where the data analysis program **104** reads the source data from the data source **108** specified in operation **502**. This may involve reading a spreadsheet file from a file system or executing a query on database server, for example.

Next, the routine **500** proceeds from operation **508** to operation **510**, where the data analysis program **104** transforms the source data from the data source **508** to the summary level data used to build the summary table **304**. This may be accomplished by applying summarization functions to the source data to produce the summary level data required to render the summary table display, based on the field selections from operations **504** and **506** above as well as any other any additional selections or parameters.

From operation **510**, the routine **500** proceeds to operation **512**, where the data analysis program **104** renders the display of the first row header area **306**A of the summary table **304** to the display device **110**. The data rows **202** from the data source **108** are evaluated to determine the applicable row label values for the row header area **306**A based upon the selected data fields from operation **504**. A hierarchy of row labels for the row header area **306**A is also constructed, if applicable. As discussed above in regard to FIG. **3**A, the data analysis program **104** may also include an aggregate row label **312**A for the row header areas **306**A to allow the row header area to be rolled up and summarized in a single row by the user **106**. Rows are added to the summary table grid containing each label value, and the data values **310** are summarized across the various column labels in the row, based upon the data fields selected for the column header area **308** and the summary level data.

From operation **512**, the routine **500** proceeds to operation **514**, where the data analysis program **104** determines if there are additional row header areas to be displayed in the summary table **304**. This may be accomplished by determining if data fields have been specified for additional row header areas in the row label selection area **602** of the summary table field list window **600**, according to one embodiment. If additional rows header areas are to be displayed, the routine **500** proceeds to operation **516**, where the data analysis program **104** renders the display for the next row header area **306**B vertically adjacent to and below the previous row header area **306**A. The next row header area **306**B is displayed using a similar procedure to the first row header area **306**A described above in regard to operation **512**. Once the display for the next row header area **306**B has been rendered by the data analysis program **104**, the routine **500** returns from operation **516** to operation **514**, where the data analysis program **104** determines if there are additional row header areas to be displayed in the summary table **304**. If no more row header areas are to be displayed, then the routine **500** ends.

It will be appreciated that a similar routine to the routine **500** described above could be utilized by the data analysis program **104** to display a summary table **404** with multiple column header areas **308**A, **308**B, wherein each subsequent column header area would be displayed in the summary table horizontally adjacent to the previous column header area. Similarly, a combined routine could be utilized by the data analysis program **104** to display a summary table with both multiple row header areas and multiple column header areas. It is intended that these routines also be included in this application.

FIG. **7** shows an example computer architecture for a computer **700** capable of executing the software components described herein for displaying multiple row and column header areas in a summary table, in the manner presented above. The computer architecture shown in FIG. **7** illustrates a conventional computing device, PDA, digital cellular phone, communication device, desktop computer, laptop, or server computer and may be utilized to execute any aspects of the software components presented herein described as executing on the computer **102** or other computing platform.

The computer architecture shown in FIG. **7** includes a central processing unit **702** (CPU), a system memory **708**, including a random access memory **714** (RAM) and a read-only memory **716** (ROM), and a system bus **704** that couples the memory to the CPU **702**. A basic input/output system containing the basic routines that help to transfer

information between elements within the computer **700**, such as during startup, is stored in the ROM **716**. The computer **700** also includes a mass storage device **710** for storing an operating system **718**, application programs, and other program modules, which are described in greater detail herein.

The mass storage device **710** is connected to the CPU **702** through a mass storage controller (not shown) connected to the bus **704**. The mass storage device **710** and its associated computer-readable media provide non-volatile storage for the computer **700**. Although the description of computer-readable media contained herein refers to a mass storage device, such as a hard disk or CD-ROM drive, it should be appreciated by those skilled in the art that computer-readable media can be any available computer storage media that can be accessed by the computer **700**.

By way of example, and not limitation, computer-readable media may include volatile and non-volatile, removable and non-removable media implemented in any method or technology for storage of information such as computer-readable instructions, data structures, program modules, or other data. For example, computer-readable media includes, but is not limited to, RAM, ROM, EPROM, EEPROM, flash memory or other solid state memory technology, CD-ROM, digital versatile disks (DVD), HD-DVD, BLU-RAY, or other optical storage, magnetic cassettes, magnetic tape, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to store the desired information and that can be accessed by the computer **700**.

According to various embodiments, the computer **700** may operate in a networked environment using logical connections to remote computing devices and computer systems through a network **720**. The computer **700** may connect to the network **720** through a network interface unit **706** connected to the bus **704**. It should be appreciated that the network interface unit **706** may also be utilized to connect to other types of networks and remote computer systems. The computer **700** may also include an input/output controller **712** for receiving and processing input from a number of input devices **112**, including a keyboard, a mouse, a touchpad, a touch screen, an electronic stylus, or other type of input device. Similarly, the input/output controller **712** may provide output to a display device **110**, such as a computer monitor, a flat-panel display, a digital projector, a printer, a plotter, or other type of output device.

As mentioned briefly above, a number of program modules and data files may be stored in the mass storage device **710** and RAM **714** of the computer **700**, including an operating system **718** suitable for controlling the operation of a computer. The mass storage device **710** and RAM **714** may also store one or more program modules. In particular, the mass storage device **710** and the RAM **714** may store the data analysis program **104**, which was described in detail above in regard to FIG. **1**. The mass storage device **710** and the RAM **714** may also store other types of program modules or data. In one embodiment, the program modules are embodied in computer-readable media containing instructions that, when executed by the CPU **702**, perform the routine **500** for displaying a summary table having multiple row header areas, as described in greater detail above in regard to FIG. **5**.

Based on the foregoing, it should be appreciated that technologies for displaying multiple row and column header areas in a summary table are provided herein. Although the subject matter presented herein has been described in language specific to computer structural features, methodological acts, and computer-readable media, it is to be understood that the invention defined in the appended claims is not necessarily limited to the specific features, acts, or media described herein. Rather, the specific features, acts, and mediums are disclosed as example forms of implementing the claims.

The subject matter described above is provided by way of illustration only and should not be construed as limiting. Various modifications and changes may be made to the subject matter described herein without following the example embodiments and applications illustrated and described, and without departing from the true spirit and scope of the present invention, which is set forth in the following claims.

What is claimed is:

1. A computer-implemented method for displaying a summary table, the method comprising:

receiving a column header data field selection associated with a plurality of column header areas of the summary table;

receiving a row header data field selection associated with a plurality of row header areas of the summary table, the row header data field selection having at least one data field different from the column header data field selection;

reading data from a data source, the data containing column data field values for data fields selected via the column header data field selection and row data field values for data fields selected via the row header data field selection;

transforming the data from the data source to summary level data for rendering the summary table; and

rendering to a display device the plurality of column header areas and the plurality of row header areas in the summary table, the plurality of column header areas comprising a distinct set of columns labeled with the column data field values from the column header data field selection, and the plurality of row header areas comprising a distinct set of rows labeled with the row data field values from the row data field selection.

2. The computer-implemented method of claim **1**, wherein an aggregate label is displayed in a row header area of the plurality of row header areas, such that the row data field values for data fields selected via the row header data field selection are summarized in a single row.

3. The computer-implemented method of claim **2**, wherein operations performed in regard to the row header area of the plurality of row header areas in the summary table affect the rendering of the plurality of column header areas.

4. The computer-implemented method of claim **1**, wherein an aggregate label is displayed in a column header area of the plurality of column header areas, such that the column data field values for data fields selected via the column header data field selection are summarized in a single column.

5. The computer-implemented method of claim **4**, wherein operations performed in regard to the column header area of the plurality of column header areas in the summary table affect the rendering of the plurality of row header areas.

6. The computer-implemented method of claim **1**, wherein rendering to the display device the plurality of column header areas and the plurality of row header areas in the summary table comprises rendering to the display device the plurality of column header areas and the plurality of row header areas in the summary table to the display device by a spreadsheet program.

7. The computer-implemented method of claim 1, wherein operations performed to an entirety of the summary table affect the rendering of both the plurality of row header areas and the plurality of column header areas.

8. The computer-implemented method of claim 1, wherein the plurality of row header areas are adjacent to each other.

9. The computer-implemented method of claim 1, wherein the plurality of column header areas are adjacent to each other.

10. An optical disk, a magnetic storage device, or a solid state storage device having computer executable instructions stored thereon that, when executed by a computer, cause the computer to:

receive a selection of data fields associated with a plurality of row header areas of a summary table;

receive a selection of data fields associated with a plurality of column header areas of the summary table, the selection of data fields associated with the plurality of row header areas having at least one data field different from the selection of data fields associated with the plurality of column header areas;

read data from a data source, the data containing column data field values for data fields selected via the selection of data fields associated with the plurality of column header areas and row data field values for data fields selected via the selection of data fields associated with the plurality of row header areas;

transform the data from the data source to summary level data for rendering the summary table; and

render to a display device the plurality of row header areas and the plurality of column header areas in the summary table, the plurality of row header areas comprising a distinct set of rows labeled with the row data field values and the plurality of column header areas comprising a distinct set of columns labeled with the column data field values.

11. The optical disk, the magnetic storage device, or the solid state storage device of claim 10, wherein an aggregate label is displayed in a row header area of the plurality of row header areas, such that the row data field values associated with the plurality of row header areas are summarized in a single row.

12. The optical disk, the magnetic storage device, or the solid state storage device of claim 10, wherein an aggregate label is displayed in a column header area of the plurality of column header areas, such that the column data field values associated with the plurality of column header areas are summarized in a single column.

13. The optical disk, the magnetic storage device, or the solid state storage device of claim 10, wherein rendering the summary table to the display device comprises rendering the summary table to the display device by a spreadsheet program.

14. The optical disk, the magnetic storage device, or the solid state storage device of claim 10, wherein operations performed to an entirety of the summary table affect the display of both the plurality of row header areas and the plurality of column header areas.

15. The optical disk, the magnetic storage device, or the solid state storage device of claim 10, wherein the plurality of row header areas are adjacent to each other.

16. The optical disk, the magnetic storage device, or the solid state storage device of claim 10, wherein the plurality of column header areas are adjacent to each other.

17. A computer, comprising:

a processor; and

a computer-readable storage medium in communication with the processor, the computer-readable storage medium comprising computer-executable instructions storage thereupon which, when executed by the processor, cause the processor to:

receive a selection of data fields associated with a plurality of row header areas of a summary table;

receive a selection of data fields associated with a plurality of column header areas of the summary table, the selection of data fields associated with the plurality of row header areas having at least one data field different from the selection of data fields associated with the plurality of column header areas;

read data from a data source, the data containing column data field values for data fields selected via the selection of data fields associated with the plurality of column header areas and row data field values for data fields selected via the selection of data fields associated with the plurality of row header areas;

transform the data from the data source to summary level data for rendering the summary table; and

render to a display device the plurality of row header areas and the plurality of column header areas in the summary table, the plurality of row header areas comprising a distinct set of rows labeled with the row data field values and the plurality of column header areas comprising a distinct set of columns labeled with the column data field values.

18. The computer of claim 17, wherein an aggregate label is displayed in a row header area of the plurality of row header areas, such that the row data field values associated with the plurality of row header areas are summarized in a single row.

19. The computer of claim 17, wherein the plurality of row header areas are adjacent to each other.

20. The computer of claim 17, wherein the plurality of column header areas are adjacent to each other.

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